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DESIGN AND IMPLEMENTATION OF PROFICIENT TECHNIQUE IN AGRICULTURE FOR WEED DETECTION AND IRRIGATION SYSTEM USING GSM TECHNOLOGY

Dr. B. Paulchamy [1] | Akshay. P. K [2] | Gokulraj. M [2] | Ajith. A. K [2] | Ananth. R [2] | Manoj. K [2]

[1] Professor & Head, Department of ECE, Hindusthan Institute Of Technology, Coimbatore-32.

[2] Final year students, Hindusthan Institute Of Technology, Coimbatore-32.

ABSTRACT

Day to day farmers facing main agricultural problems is weed effect, monsoon changes, and time conception. The traditional farming method is unable to improve the crop yield and does not solve farmer's day today problems. That's why the farmers start to implement the various technologies to achieve better yield, reduce the time conception and required man power. This paper represents the 3 in 1 prototype design based on Automatic Weed Detection and Sprayer System and Automatic Irrigation System with GSM Protocol. Based on their function, the prototype system has 3 processes in agricultural field. But the whole processes are simultaneously working together. This is the main advantage of this prototype system from traditional method. To achieve the new weed detection the plants must be classified into weeds and crops according to their properties. The algorithm like image processing is used to identify the crop and weed. The prototype system detects the weed, the smart sprayer effectively sprays the herbicide on the weed detected area [1]. The process continues at every specific time interval and it reduces the time consumption and required man power. The proposed system also consists of an automatic irrigation with soil moisture sensing sensor [14] and GSM protocol, the main advantage of the GSM protocol is that the farmer can control the both spraying and automatic irrigation system by sending a message to the proposed system.

KEY WORDS: Vision system; Image processing, MATLAB, Microcontroller, GSM module, IR sensor, Moisture sensor, Relay, DC motor.

1. INTRODUCTION

In the traditional method of farming, removal of weeds in plants is a serious issue. It takes more man power to control the weeds from affecting the crops. To reduce this man power, methods like spot spraying and patch spraying were introduced. These techniques mainly use spatial distribution and remote sensing using GPS to detect the weed in crops. In the recent times, more advanced methods and efficient methods can be implemented i.e. Image processing techniques can be used for weed detection [13]. These techniques costs lower than that of remote sensing. Region based segmentation can be used to detect weeds in corps in a region and it can be continued for the whole farm i.e. first a sample image is given to the system and at different intervals another sample image is taken by the system and the differences between the image is processed in MATLAB [10] then in the affected region herbicide is sprayed. This system can control four rows at a time and it can be modeled in to 6-8 rows at a time. In India, most of the irrigation systems are operated manually. In recent trends they are replaced by semi-automated techniques. However using a PIC microcontroller Irrigation can be done in a fully automated mode. The process involves dividing the farm into sectors and for the each sector a humidity sensor is placed to detect the moisture level in the soil [11]. The system automatically provides water for the crops when the moisture in the soil gets below the base value or set value. The vision of this paper is to design a system which can perform both weed detection and automated irrigation system in a less complex manner. Then a GSM is also been used to confirm the process i.e. the user can operate the system anywhere by sending a message to the system [4]. The main goal of the system is to introduce a user friendly embedded system to farmers which can help them to reduce man power, reduce money, and to improve the production of yield.

2. MATERIALS AND METHODS

In this system, different features of the weed such as shape, color, Texture were given as input. Then the hardware system consists of a 10 mp camera for capturing the image of the crops and a DC motor is used for the purpose of sprayer, Image processing is done using MATLAB software. Similarly in the irrigation process an IR sensor is used for moisture detection and is embedded with the same microcontroller. The figure1 shows the overall function of the proposed system which includes an IR sensor, a microcontroller unit, various relays, a DC motor, a buzzer and driver.

- This sensor is mainly used to measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistances, dielectric constant or interaction with neutrons as proxy for the moisture content.

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- An infrared sensor is a type of photoelectric beam system used as an electronic alarm. It is designed to alert the user to an intruder's presence by transmitting infrared light beams across an area, where these beams may be obstructed. In our project we use this IR sensor for the purpose of intrusion detection in the farm field and are immediately connected to the GSM modem for notification to the farmers.

- A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches and are used in many applications because of their relative simplicity, long life, and proven high reliability. In this paper relays are used to run the motor. Two relays are used in the proposed system for both irrigation and sprayer motor.

- The PIC (I6F877A) is an 8 bit microcontroller. It is a high-performance RISC CPU. In this proposed system the microcontroller is used for three purposes i.e. the three major processes such as weed detection, irrigation and intrusion detection are controlled by this microcontroller. PIC microcontroller is used because it is a low-power, high-speed CMOS FLASH/EEPROM technology.

- Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. In this system the GSM modem is used for only two processes. When the microcontroller gets notification on any one of infection or intrusion in the field, it enables the GSM modem to send a message to the user about the condition.

- In this system a 10 megapixel camera is used to capture the image of the crops. The camera can be set in a wide angle in order to capture different crops in one image. The image thus taken is sent to the computer for image processing. According to the image necessary the frame length can be set for the image to be captured.

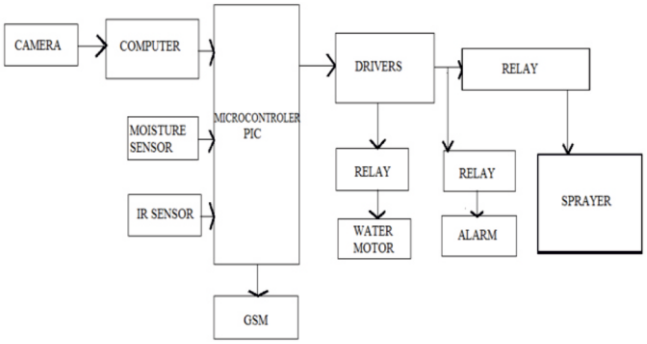

Figure 1: General Block Diagram of the proposed system

2.1. IMAGE PROCESSING

The main use of image segmentation is to partition the digital image thus obtained from the camera into set of pixels. Then the pixels value thus obtained in the original image and the reflected image are compared to find the infection occurred in the image. Image segmentation is mainly used to locate objects and boundaries in image. The figure 2 shows the process that takes place in MATLAB.

The median filter is mainly used to remove noise in the image i.e. mostly salt and pepper noise. The image thus segmented is filtered off so that the image extraction can be done easily. The image which is segmented in the above process into pixels is reduced in to set of features i.e. the redundancy of pixels is removed and it is transformed into an image with relevant information so that the image can be used for further processing. After the extraction process the image is analyzed. Mostly low level detection such as edge, corner, and intensity are used to detect any changes in the image. If there is an infection in the leaf an high level signal '1' is sent to the microcontroller and if the image is found out to be normal an low level signal '0' is sent to the microcontroller.

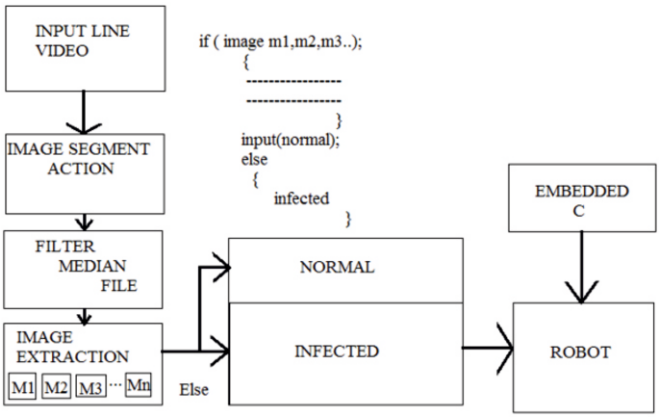

Figure 2: Block Diagram of Image Processing

3. RESULTS & DISCUSSION

This section represents the result of the proposed system i.e. the weed detection and automatic irrigation in a combined circuit is much more efficient than that of the conventional methods. Image processing techniques are done using MATLAB and it is executed without code optimization. Similarly the algorithm that is used in the proposed system has an accuracy of 91%.The image processing algorithm may take 0.344s to process one frame of a 256*240 pixel image representing a 11.43cm by 10.16cm field of view with objects in an Image.

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The microcontroller is the main block of the system; it controls the relay, sensors, motors connected to it. The camera captures image at regular intervals and it compares it with the reference image if any infection occurs, it relays the information to the microcontroller, it automatically starts the sprayer system and it also sends a message to the user about the infection. Similarly the moisture sensor calculates the moisture level in the soil and sends it to the microcontroller; the microcontroller takes action according to the signal received from the sensor. The IR sensor sends information about any intrusion in the field to the microcontroller and the microcontrollers starts the buzzer if any intrusion is detected and sends a message to the user about the intrusion.

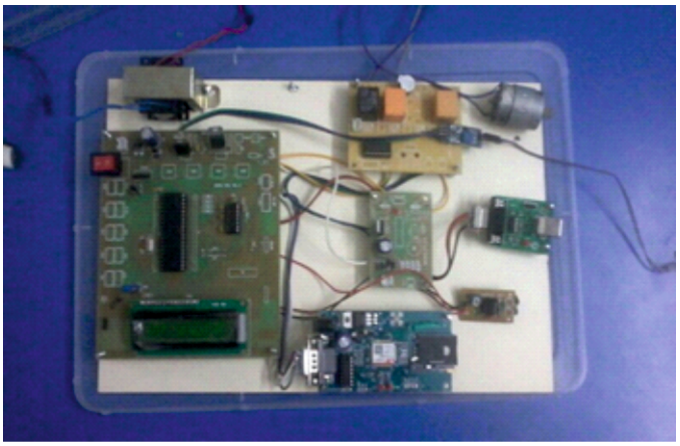

Figure 3: Snapshot of our designed kit

4. CONCLUSION & FUTURE WORK

This system mainly works on the purpose to implement a system that does the three given features more efficiently and this can lead to automation on most of the process. The output of the system indicates that in the early stages the automatic systems are more flexible than the traditional system. This system efficiently reduces the cost of production and manpower. The weeds that are grown in plants can be killed using herbicides or chemical fertilizers. In the future work, the same system can also be implemented to detect the diseases that are occurring in plants such as change in color in leaves, change in shape, and texture in plants and also wireless camera can also be used instead of wired so that it can be accessed anywhere using GPS or wifi.

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AUTHOR'S DETAILS

AKSHAY PK is pursuing his final year Electronics and communication engineering in Hindusthan Institute of Technology, Coimbatore-32. He completed his schooling in GOVT. Hr.Sec.School Irumbuzhi. He has participated many technical symposium, Project expo, Seminar, workshop and conferences of various Engineering colleges.

GOKULRAJ. M is pursuing his final year Electronics and communication engineering in Hindusthan Institute of Technology, Coimbatore-32. He completed his schooling in K.A.P.V.Hr.Sec.School Trichy. He has presented many technical papers in symposium and conferences of various Engineering colleges. He is placed in Cognizant Technology Solutions.

AJITH. A. K is pursuing his final year Electronics and communication engineering in Hindusthan Institute of Technology, Coimbatore-32.He completed his schooling in Carmel Hr.Sec.School. He has presented many technical papers in symposium and conferences of various Engineering colleges.

ANANTH. R is pursuing his final year Electronics and communication engineering in Hindusthan Institute of Technology, Coimbatore-32.He completed his schooling in Nadar saraswathi Hr.Sec.School. He has presented many technical papers in symposium and conferences of various Engineering colleges. His area of interest is Digital Signal Processing and networks.

MANOJ. K is pursuing his final year Electronics and communication engineering in Hindusthan Institute of Technology, Coimbatore-32.He completed his schooling in Vidhya Vikas Hr.Sec.School. He has presented many technical papers in symposium and conferences of various Engineering college.

Dr. B. Paulchamy received his Ph.D. in Digital Signal Processing, Approach for De-Noising from EEG signal from Anna University Chennai, M.E degree in Applied Electronics from PSG College of Technology, Coimbatore, affiliated to Anna University Chennai, TamilNadu and B.E degree in Electronics and communication Engineering from National Engineering College, Kovilpatty, affiliated to Anna University Chennai, Tamilnadu. He has more than a decade of teaching experience in various Engineering colleges in Tamil Nadu. Currently he is working as Professor & Head in the department of ECE at Hindusthan Institute of Technology, Coimbatore. His research interests include Signal processing, Image processing and soft computing. He published around 15 papers in refereed conferences and journals. He is the Life Member in the Indian Society for Technical education.